



Space News Roundup

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No. 17



The Hubble Space Telescope's port solar array is unfurled while the telescope remains attached to Discovery's remote manipulator system robot arm. The scene was recorded from a live television downlink Wednesday, prior to the telescope's successful deployment.

Discovery soars, Hubble ready to reveal universe

By Kelly Humphries

After one last tense hour that brought Astronauts Bruce McCandless and Kathy Sullivan within 30 minutes of a space walk, the crew of Discovery deployed the Hubble Space Telescope (HST) on Wednesday and set the stage for a new era in human awareness.

Mission specialist and astronomer Steve Hawley pulled the release trigger on the remote manipulator system (RMS) controls at 2:38 p.m. CDT and the robot arm allowed the \$1.5 billion telescope to drift free in a 332.8 nautical mile orbit. Hawley and Pilot Charlie Bolden became shutter-bugs, snapping photos and filming the telescope as it drifted away.

Commander Loren Shriver then fired Discovery's reaction control system (RCS) jets to put some distance between the shuttle and the telescope. Discovery and its crew were to fly formation with HST about 42 nautical miles away until its aperture door opened, which was scheduled for 9:15 a.m. today.

"Thanks for the great work you've done," CapCom Story Musgrave told the crew from Mission Control. "Galileo is real proud of you."

"It was our pleasure, too," Shriver responded.

Astronomers equate the significance of the HST launch to Galileo's early studies of the universe with his crude 17th century telescope. HST

is half a billion times more sensitive than the human eye and will have resolution better by a factor of 10 than any previous optical telescope. Its first test image next week will be of a star cluster in the Southern Hemisphere called NGC 3532.

The last tense period in the deployment occurred when HST's starboard solar array failed to unfurl completely after several attempts. But at 2:03 p.m., troubleshooting efforts by controllers in the Space Telescope Operations Control Center (STOCC) at Goddard Space Flight Center resulted in the smooth roll out of the window shade-like solar panel.

McCandless and Sullivan had worked through the preparations for an extravehicular activity (EVA) to help complete the solar panel's deployment. They had completed a 40-minute prebreath and depressurized the airlock to 5 pounds per square inch (psi).

"Close but no cigar," Sullivan said as she and McCandless prepared to return to the shuttle middeck from the airlock. "Better for Hubble it went the way it did."

Lead Flight Director Bill Reeves said the veteran space walkers "were probably 30 minutes away from being out in the payload bay with tools in hand and ready to work."

Before the last hitch, HST deployment activities had been relatively smooth. Please see **DISCOVERY**, Page 4



Procurement adjusts organization

JSC Procurement Director Gene Easley this week announced several organizational changes designed to provide a more efficient and balanced operation to handle JSC's \$2.9 billion annual procurement activity.

Easley said the changes are not related to the recent centerwide reorganization that created the new Information Systems Directorate and divided many mission support functions between the Engineering and Mission Operations Directorates.

"We're just making some organizational adjustments and workload realignments brought about by JSC's changing role over the past six years,

including increased space station procurement activities," Easley said. Prior to these changes, procurement has remained the same organizationally since 1984.

Among the changes are the elimination of the Research and Engineering Systems Procurement Branch (BE4), the Institutional Support Procurement Section (BG32) and the Base Operations Procurement Section (BG33).

Easley created a new branch, the Aircraft Operations and Materiel Procurement Branch (BG5), and a Huntington Beach Resident Office (BF4), a new office to support McDonnell Douglas' work on Space

Station Freedom in California.

"With the space station program coming on line, we felt we needed to establish a contract office there," Easley said. "It's similar to the NASA contract office at Rockwell's Downey, Calif., plant."

Also, the Data Systems and Aircraft Operations Procurement Branch (BG4) has been renamed the Data Systems Procurement Branch with the aircraft operations procurement activity going to the newly established branch (BG5). The data systems procurement activity has and will continue to be a heavy workload necessitating a dedicated Please see **PROCUREMENT**, Page 4

Columbia crawls to pad for May 16 launch

Two shuttles on pads at same time

Transporter crosses 1,000 mile marker

By Kyle Herring

For only the second time, space shuttles occupied both Kennedy Space Center pads as Columbia joined Discovery last Sunday at Launch Complex 39.

Columbia, with the ASTRO-1 ultraviolet astronomy telescope and Broad Band X-ray Telescope (BBXRT) in the payload bay, made the 3.5 mile trip from the Vehicle Assembly Building (VAB) to Pad 39A in preparation for the STS-35 mission targeted for launch May 16.

Once at the pad, validation tests were conducted and Columbia was powered up in preparation for the Terminal Countdown Demonstration Test (TCDT) with the crew. The mock countdown was scheduled to begin today at 7 a.m. CDT and end with a simulated engine cutoff Saturday morning.

The crew for STS-35 was scheduled to travel to the Kennedy on Thursday to take part in the final hours of the TCDT when they board

Columbia and conduct a practice run of launch day activities.

Launch on May 16 is scheduled for 12:45 a.m. EDT or just before midnight Houston time May 15. Shuttle managers will meet May 7 and 8 for a Flight Readiness Review to determine an exact launch target. The mission is expected to last almost nine days and end with a landing at Edwards Air Force Base, Calif., on May 24.

Commander of STS-35 is Vance Brand and pilot is Guy Gardner. Brand is making his fourth space flight, having flown on the Apollo-Soyuz Test Project mission that docked with a Soviet spacecraft in 1975. He also commanded two previous shuttle flights, STS-5 and STS 41-B. Gardner piloted Atlantis on the STS-27

Please see **SHUTTLES**, Page 4

By Kyle Herring

Two diesel engines producing more than 5,000 horsepower are started, and as the powerplants warm up the 4-mile trip begins at a blistering pace of about half a mile an hour.

Before completing its first mile Sunday carrying Columbia from the Vehicle Assembly Bldg. to Launch Complex 39A, Crawler Transporter 2 crosses the "1,000 mile marker" and a ceremony marks the historic event in the background.

While not the most fuel efficient of vehicles, consuming 160 gallons a mile, the crawler transporter used to carry space shuttles from the massive VAB to the launch pad is as vital a piece of hardware as the cargo it carries.

It took 25 years for the first of the 6 million pound vehicles to reach the 1,000-mile mark,

something an Indy car would surpass in just five hours. Transporter 1 is running a lose second in miles traveled with 975; it should reach the 1,000 mile mark in 1991.

The twin giant crawlers have been the only means of transporting manned spacecraft to the launch pads at the Kennedy Space Center since the Apollo Program. Early concepts of launch vehicle transports, however, didn't include a land-based vehicle. "The crawler transporter was the dark horse of the concepts being considered," said Donald Buchanan, then chief of the Launcher Systems and Umbilical Tower Design Section.

Early concepts included a barge and canal system, a rail system and the land transporter. "Eventually," he said, "the barge/canal concept proved too unstable and the rail system more costly and inflexible due to the loads it would be require to carry."

Please see **CRAWLER**, Page 4



Weitz commends employee conservation efforts

JSC Deputy Director P.J. Weitz thanked JSC civil servants and contractors this week for their "enthusiastic" contributions to the center's energy conservation efforts.

Weitz said conservation by NASA and contractor employees saved JSC an estimated \$5,000 on its March electric bill. Several organizations also have coordinated plans for reducing electric equipment operations that should lead to additional savings of about \$125,000 a year, he said.

Weitz also said that, due to the coming summer weather and the increasing space shuttle flight rate, he is revising after-hours air conditioning restrictions for employees working Saturday mornings.

When the conservation program began in January, Weitz directed that all nonessential air conditioning be shut off after 6 p.m. and on weekends.

On-site workers now may call for air-handler service between 8 a.m. and noon Saturday mornings. Only

members of JSC's senior staff and their deputies may authorize heating and cooling after hours at other times.

"This relaxing of air-handler service restrictions in no way reduces the JSC commitment to energy conservation," Weitz said Tuesday. "I am asking each of you to join me as custodians of the nation's energy resource. After-hours air conditioning and heating should be used only if essential."

"I urge each of you to continue to share in our sense of responsibility

for energy conservation at JSC, and I want to express my thanks for your past efforts in conserving national resources. I also want to thank those of you who have sent me conservation suggestions, and I encourage you to keep them coming."

Employees may call x33061 to request air-handler service, and will need to provide the name of the authorizing individual, the air-handler number or location, the start time and the stop time.

Did You Know?



That a personal computer uses about 5 cents worth of electricity every hour?

Or that if one third of JSC's personal computers were left on overnight, it would cost the center \$107,447 a year?

JSC

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Gift Store from 10 a.m. to 2 p.m. weekdays.

General Cinema (valid for one year): \$3.75 each.

AMC Theater (valid until May 1991): \$3.50 each.

Sea World (San Antonio, year long): adults, \$17.25; children (3-11) \$14.75.

Astroworld (valid 1990 season): season, \$39.95; regular, \$15.97; children, \$9.21.

JSC EAA Picnic tickets (May 5, Rec Center): adults, \$4; children, \$2.50.

"Flying the Apollo Mission" (video): \$20 each.

New Orleans Fling (June 23 & 24; \$25 deposit by May 15): \$125 each.

Comedy (Radio Music Theater, 2623 Colquitt, near Richmond and Kirby, advanced reservations required call 522-7722; mention that you are with NASA and your entire group will be admitted free to any 8:30 p.m. Thursday or 10:50 p.m. Saturday performance of your choice during the month of April.)

Galveston Home Tour (May 5,6,12,13): \$10 each.

JSC

Gilruth Center News

EAA badges—Dependents and spouses may apply for a photo I.D. 6:30 p.m.-9:30 p.m. Monday-Friday.

Defensive driving—Course is offered from 8 a.m.-5 p.m. May 19 and June 16; cost is \$15.

Weight safety—Required course for those wishing to use the Rec Center weight room. The next classes will be from 8-9:30 p.m. May 2 and May 16; cost is \$4.

Ballroom dance—Beginning, intermediate and advanced ballroom dancing. Classes begin May 3 and meet every Thursday for eight weeks. Beginning and advanced classes meet 7-8:15 p.m. Intermediate class meets 8:15-9:30 p.m. Cost is \$60 per couple.

Aerobics and exercise—Both classes are ongoing. Sign up in the Rec Center.

Spring intercenter run—The 10 kilometer and/or 2-mile races for the annual intercenter run will be held throughout April. Runners may submit their times at the Rec Center.

Country and Western dance—Lessons begin June 4. This course will be held every Monday for 6 weeks, cost is \$20 per couple.

Mixed Volleyball Sign-ups—Registration will be held on May 2. This season will consist of a Monday, Tuesday, and Friday night league. NASA badged teams will be signed up first.

JSC

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2.

Property

Sale: Waterview lots near NASA, mid \$30's. Don, x38039 or 333-3313.

Rent: Pecan Forest, LC, 3-2-2, FPL, \$725/mo. 554-6200.

Rent: 3 mobile home lots, \$50/dep., \$50/mo. 326-5110.

Lease: Tranquility Lake, 1-1-1CP, W/D, microwave, FPL, fans, upstairs, \$200/dep., \$400/mo. Vic, x30189 or 333-2482.

Sale: Hilltop Lakes property, 80x120 lot w/ taxiway to runway, \$6,000, owner fin. w/20% down. 554-6201.

Sale: 2 res. lots, ea. 70x185, Friendswood area, owner fin. w/10% down. 482-5226.

Lease: Univ. Green patio home, 3-2-2, fans, gar. door opener, avail. May 15, \$750/mo., \$750/dep., ref. 486-8551.

Rent: Mobile home lot, \$85/mo., \$50/dep., Oklahoma and Kinne, Bacliff. 488-1758.

Sale: LC 14x80 mobile home on priv. lot, 100x150, trees, \$23K. 334-1883.

Sale: Woodward vac. home, 2-2-1/2CP, furn., \$45,000, owner fin. (409) 891-5190.

Rent: LC, 3-2-2, FPL, fen., no pets, \$750/mo. 554-6200.

Sale: Camino SO, 3-2-2, hdwd. floors, new carp., near RSO, 9.5% FHA assum., \$79,900. Brian, 483-7070 or 280-8500.

Lease: Condo in Webs./Ellington area, lg. 2-1, new carp., paint. Dave, x38156 or 486-5181.

Rent: Lake Travis cab., cen. AC/H, accomm. 8, \$325/\$425 w/ky., \$75/\$85 daily. 326-5652.

Sale: 60 acres, 3 mi. from Karnes City, TX, 50 mi. from San Antonio; 2-story house on 1.5 lots, fruit trees in El Campo. 783-9164.

Lease: Pipers Meadow, 3-2-2 w/study, form. DR., lg. fam. rm., refrig., gar. door opener, near NASA, \$759/mo. 486-5659.

Sale/Lease: Brook Forest, CLC, 4-2-5-2, 3,000 sq. ft., 2-story, gamerm./den, pool, new paint, carp., wallpaper. Krishna, 486-2057.

Rent: Mobile home lot in Dickinson, \$70/mo. 282-2802 or 332-0365.

Rent: 1 BR condo, El Dorado, W/D, fans, new carp., \$375/mo. 486-9162.

Lease: Furn. condo in Dallas for summer lease, by SMU campus. 333-3925.

Lease: 4-2-2, El Lago, all appli., avail. May 1, \$800/mo. 326-6811 or 488-8611.

Sale: Bay house on Caranchua Bay near Palacios, furn., acc. to boat ramp, pier, \$40,000. (409) 543-2052.

Rent: Galv. condo, furn., sleeps 6, dly./wkly. x33479 or 486-0788.

Cars & Trucks

'81 Olds Cutlass Cruiser wagon, ex. cond., \$1,795. David, 554-5514 or 282-3827.

'63 VW Beetle conv., all mech. sys. reb., \$2,900. Anne, x36923 or 532-2003.

'85 Chevy K-5 Blazer, 4x4, Silverado pkg., 57K mi., loaded, ex. cond., \$9,000, OBO. 333-7141.

'88 Suzuki Samurai JX, AM/FM cass., 5-spd., ex. cond., \$6,300. Genie, 488-0186.

'65 Olds Starfire sport coupe, good cond., \$2,500, OBO. Tom, x38298 or 488-4089.

'86 Ford Thunderbird, 4 cyl. turbo, 2-dr. coupe, AM/FM, ex. cond., \$6,900. 538-1711.

'77 Ford Granada 4-dr., loaded, V8, auto., AC, PS, good cond., \$950, OBO. 554-6201.

'71 Chev. C20 PU w/camper, 4-spd., 6 cyl., good cond., \$1,375, OBO. 554-6201.

'88 Honda Accord LXI, 5-spd., 2-dr. coupe, loaded, ex. cond., 24K mi., \$9,800. Bruce, x37677 or 480-0024.

'84 Dodge Daytona, turbo, 5-spd., loaded, 82K mi., good cond., \$2,400. 282-6236 or 488-7999.

'85 T-bird Elan, V8, ex. cond., NADA list price. Richard, 538-1854.

'85 Buick Park Ave., 4-dr., new tires, 56K mi., ex. cond., \$500 below NADA retail. 482-1535.

'84 Ford F-150 PU, 302, V8, auto., loaded, ex. cond., 55K mi., \$4,250. Musgrove, x38356 or 488-3966.

'81 Subaru Htchbk., 43K mi., AM/FM AC, ex. cond., \$2,300. 333-2717.

'84 Cougar LS, AC, AM/FM ster. cass., ex. cond., \$4,375. Betty, 996-8471.

'88 Thunderbird turbo coupe, all pwr., ex. cond. Paul, 282-3234 or 488-3634.

'85 Toyota MR2, loaded, ex. cond., 55K mi., \$5,900. Youm Nguyen, 483-2142.

'76 Datsun station wagon, good cond., \$700, OBO. x33653 or 488-2239.

'82 Nissan 200SX, 5-spd., needs new clutch, \$750. Roy, 280-1500, ext. 1049.

'82 Porsche 924, ex. cond., 62K mi., 5-spd., \$6,500. 280-8796 or 283-5471.

'80 Honda Accord, 5-spd., AM/FM, 93K mi., \$1,400. 480-3519.

'85 Silverado Suburban, auto., all pwr., ex. cond., \$7,500. Nan, 283-6369 or 334-1508.

'86 Dodge Mini Ram van, auto., \$5,695. 280-4416 or 992-1996.

'87 Volvo 245 GLA, ex. cond., loaded, 52K mi., 3rd seat, \$13,900. Scott, 283-5611 or 482-1809.

'81 Toyota Cressida, loaded, auto., \$3,000. 534-4607.

Cycles

'81 Kawasaki 440 LTD, 6K mi., new tires/belt, ex. cond., \$800. x35916 or 326-2344.

Vista Elite touring bike, \$120, OBO. Katy, x34546 or 486-9556.

'82 Suzuki GS 550 MZ Katana, 11K mi., good cond., \$800, nego. Kevin, 333-7076 or 480-2549.

'87 Spree Moped, 3,300 mi., good cond. 488-6665.

'81 Suzuki 850cc motorcycle, vetter fairing/windscreen, low mi., ex. cond., \$1,400. Patrick, x32635 or 488-1079.

Yamaha Maxim 400 motorcycle, 3,600 mi., 2 helmets, \$600. Dave, x32801 or 480-4147.

Boats & Planes

'28' Express Cruiser, ex. cond., lift, gen., full camper, AC/DC refrig., \$14.9K, OBO. 280-8796.

'78 22' MacGregor, 3 sails, 7.5hp OB, ex. cond., VHF radio, trlr., \$4,600. 332-7167.

'87 8' Taiwan-built hard dinghy, \$400; 5hp outbd., \$340. 334-4265.

Aircraft propeller, Sensenich 74DM6-0-58, overhauled, fits some Beech, Piper PA-18, PA-22, PA-28 series aircraft, \$900. 538-2299.

'15' Tidecraft bass fishing rig w/trlr., 50hp Merc. and Super Motorguide trolling motor,

Today

Cafeteria menu—Special: meat sauce and spaghetti. Entrees: baked scrod, liver and onions, fried shrimp. Soup: seafood gumbo. Vegetables: green beans, buttered broccoli, whipped potatoes.

Monday

Cafeteria menu — Special: wieners with baked beans. Entrees: beef chop suey, breaded cutlet with cream gravy, grilled ham steak. Soup: beef and barley. Vegetables: buttered rice, Brussels sprouts, whipped potatoes.

Tuesday

MPAD Wake and Reunion—May 1 is the last day for all former civil service Mission Planning and Analysis Division employees to sign up for a wake and reunion. Please contact Gloria Martinez, x38092, to sign up.

ABWA Event—The American Business Women's Association (ABWA) will honor a member of the business community with its ABBY Award May 1 at the Rec Center. Dinner is \$13, and the guest speaker is Catherine Smith, Channel 2 News. Contact Carolyn Lowmore for more information at 326-5327.

Cafeteria menu—Special: pepper steak. Entrees: fried shrimp, pork chop with applesauce, turkey a la king. Soup: celery. Vegetables: au gratin potatoes, breaded squash, buttered spinach.

Wednesday

IEEE video conference—"The Rapid Development of Software" will

be discussed from 11 a.m.-2 p.m. May 2 in the Rec Center; contact Andy Lindberg, x31474, before April 26 to register.

Cafeteria menu — Special: Mexican dinner. Entrees: fried catfish with hush puppies, braised beef ribs. Soup: seafood gumbo. Vegetables: Spanish rice, ranch beans, buttered peas.

Thursday

"Cinco de Mayo" luncheon—The JSC Hispanic Advisory Committee will hold a luncheon at 11:30 a.m. May 3 in the Rec Center. For more information please call Lupita Armendariz, Hispanic Employment Program Manager at x30604.

Cafeteria menu — Special: hamburger steak with onion gravy. Entrees: corned beef with cabbage and new potatoes, chicken and dumplings, tamales with chili. Soup: split pea. Vegetables: navy beans, buttered cabbage, green beans.

Friday

Cafeteria menu — Special: barbecue link. Entrees: deviled crabs, broiled codfish, liver and onions. Soup: seafood gumbo. Vegetables: buttered corn, green beans, new potatoes.

May 8-9

AAS Symposium — The American Astronautical Society (AAS) will host a two day symposium entitled "Innovative Technologies for the Space Exploration Initiative", May 8-9 in the Rec Center. Call Peg Halford at 333-7754 for information.

May 11

Inventor's luncheon—The fourth annual JSC Inventor's Luncheon will be held May 11 in the upstairs dining room of the Rec Center, Rm. 216. Aaron Cohen will present 47 plaques to 40 inventors this year. For more information, contact the JSC Office of Patent Counsel, x31012.

May 15

Information security—The University of Houston-Clear Lake will hold a conference May 15-16 to address the issue of protecting information and information systems. The cost is \$150 for government employees, \$250 for industry, \$60 for students, and includes lunches and materials. Contact Glen Van Zandt, x33069, for registration information.

June 3-6

International Conference—The Space Summit will be having an International Conference on Manned Space Exploration June 3-6. For more information call 1-800-448-4053.

June 15

MPAD Wake and Reunion—The Mission Planning and Analysis Division no longer exists as of March 30, 1990. A wake and reunion (W&R) for all former civil service MPAD'ers has been planned for Friday evening, June 15, at the Rec Center Pavilion. Plans are being made to have T-shirts and/or patches with the MPAD logo on them for the W&R.

Swap Shop

\$1,050, OBO. 488-4453.

'77 17' Bayliner runabout, 190hp V8 Volvo IO, galv. trlr., good cond., \$3,500, OBO. 554-6201.

'78 Johnson 140 outbd. motor, control cables, 2 stainless props (15, 19 pitch), ex. cond., \$2,150. Andy, 333-6671 or 332-9105.

'19' V-hull Sconercraft, 22' Tan. ax trlr., Mercruiser motor, \$500, OBO. Joyce/Jim, 483-8340 or 337-5909.

'79 16' Renegade boat, 140hp Evin., SST prop, ex. cond., \$3,750, nego. 333-6868 or 486-7846.

'83 25' Catalina, 7.5hp Johnson, 6 sails, trlr., \$13,500, OBO; '83 EZ loader trlr., galv., accomm. 25' sailboat, \$1,500, OBO. Mike, 474-5414.

'14' Flying Fish sailboat, 23' mast, trlr., PFD's, \$450. 280-2510.

Personal

The Houston Chap. of the Virginia Tech Alumni Assoc. will be having a Hokie happy hour Fri., May 4, 5:30-7:30 p.m. at Dirty's, 3230 Chimney Rock, no cov., cash bar, snacks. Jeff Tave, 333-7007 or 334-2336.

Audiovisual & Computers

Compl. video theater, Sansul ster. sys., RCA Colortrak 2000 TV, VHS ster. Hi-Fi VCR, Pioneer compact disk/laserdisc player, \$2,250. 333-7141.

Commodore 64K computer, 1541 disk drive, Star printer, modem, \$300. 554-2470.

IBM XT computer, monitor, keybd., hard disk, \$950. 483-0092 or 481-3637.

PC-XT, 640K, 20 MB, dual floppies, CGA w/monitor, 101 keybd., \$1,200, OBO. James, 554-2929.

PC-XT clone, 640K Ram, math co-roc., 2 360K floppies, CGA card, \$550; modem, \$50; color monitor, \$75; Inkjet printer, \$25. Steve, x38651.

Tempo spd. reading pkg., 12 audio cass. book, \$50. Larry, 282-3161 or 996-1013.

IBM 8088 comp., dual 5.25 floppy, 256K Ram, monitor, keybd., \$350, OBO; Amstrad word proc./comp., monitor, printer, keybd., ex. cond., \$350, OBO. 333-7136 or 280-8777.

Macintosh Plus, 2M Ram, Datadesk 101 Keybd., \$950; Microsoft Excel 2.2, \$200; display server board for SE, \$225. Jim, 996-9324.

Household

Kingsz. wrbd. w/new htr., new matt., bkcs. hdbd., sheets, \$225. Lynda, 335-1226.

Kingsz. BR set, ex. cond., hdbd., split semi-motionless matt., w/dual htrs., dresser w/hutch, 2 end tables, \$600. 471-4100.

Microwave, \$75; recliner, \$75; din. w/4 chairs, \$75; coffee, end table, \$30; arm chair, \$30/ea. 481-2006.

Solid maple dresser w/bev. mirror, antique qual. 283-5496 or 332-1614.

High qual. wtr. filter, new. \$99, OBO. 283-5496 or 332-1614.

Musical Instruments

5-pc. Ludwig drum set, Zildian crash, ride, top hat cymbals, ex. cond., \$600; upright piano, refin. oak, ex. cond., \$300. x33335 or 488-7490.

Kohler & Campbell piano, oak studio console, ex. cond., \$1,250. 488-8409.

Ovation acoustic legend guitar, case, ex. cond., \$400. 482-9172.

Pets & Livestock

2 fem. Rotweiler puppies w/papers, born Jan. 15, 1990, \$350/ea. Sean, 480-8190 or 996-7693.

Free purebred Himalayan Persian silver point, male, 2 1/2 yrs. old, declawed, neut. Anne, x36923 or 532-2003.

Easter bunnies, lop-eared and reg. 554-6200.

Aus. shepherd pups, born 2-22-90, blk. tri colored, 1st shots, wormed, tails docked, \$50. Lynell, 280-2551 or 485-2101.

Free fem. puppy, 5 mos. old, 1/2 bloodhound, 1/2 pointer, all shots. Terri, 488-5906.

Rabbits, \$10-17, would lady who bought gray dwarf please call; Siberian Husky, \$150. 554-6200.

Zebra finches, white w/brn. doves, guinea pigs, \$10, OBO. Jim, 282-3750 or 482-6744.

Lab puppies, born Feb. 23, 7 blk., 4 white, mother-AKC papers, father, Golden Ret. Patsy, x34592 or 488-3619.

Stud ser., Ger. Rotweiler, championship bloodlines, AKC papers. 337-3122.

Wanted

Want male roommate to share 3 BR LC home, Meadow Bend subdiv., \$300/mo., bills pd. John, 483-1929 or 334-3422.

Want young, prof., non-smoking roommate to share new 3 BR house in LC, avail. June, \$375 plus 1/2 util. Mike, x31027 or 488-8636.

Want to buy house in Brook Forest, 4-2-5-2, price up to \$150K, closing flexible, no agents. 480-0970.

Want plas. cages and/or access. for hamsters. Herman, 483-5095.

Want to carpool from Sugarland, Missouri City area. 499-0312.

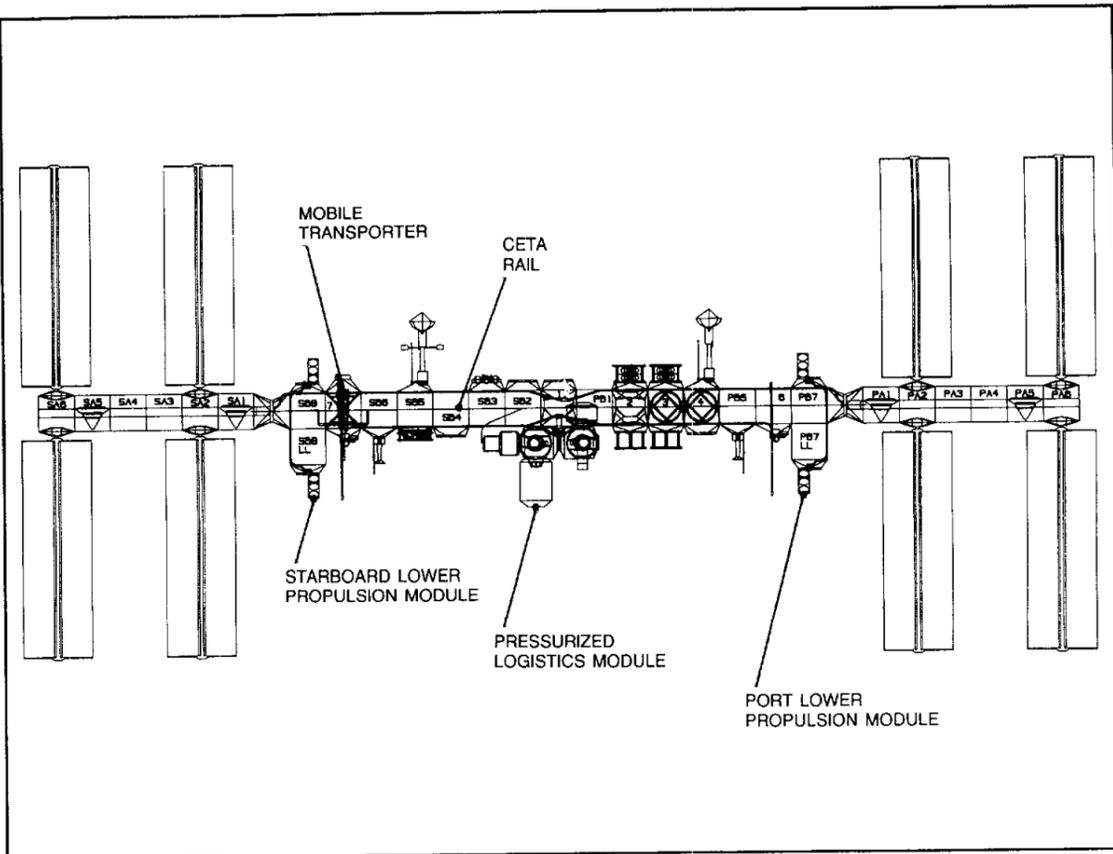
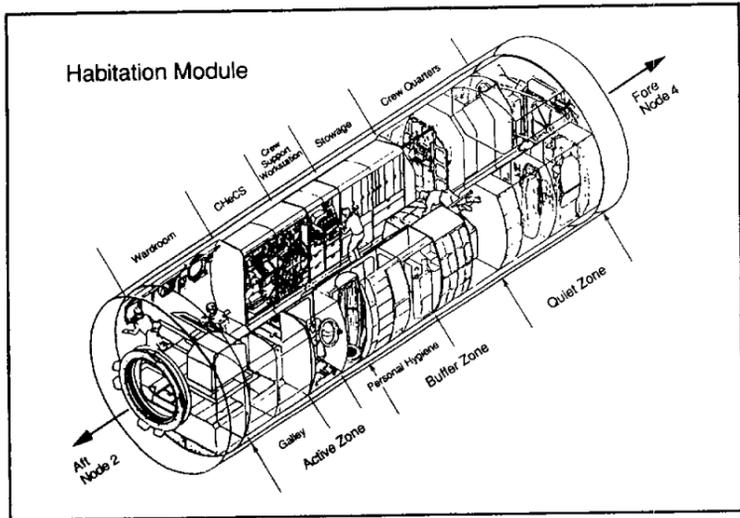
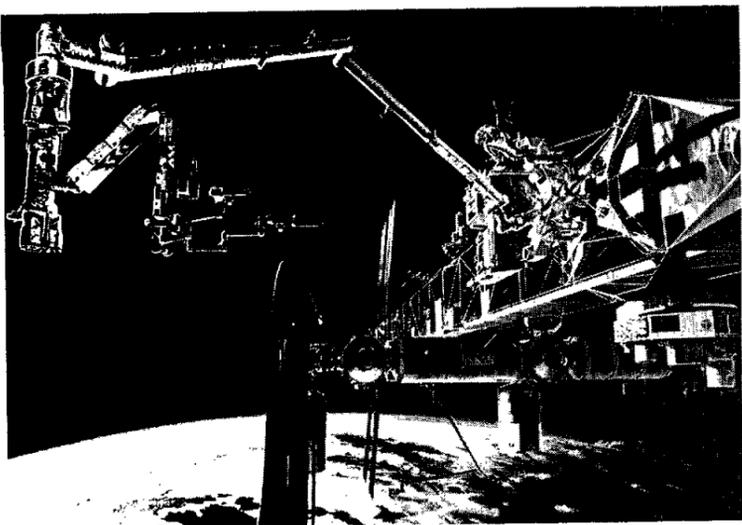
Want to rent 2-3 BR house in Bacliff, Seabrook or CL/LC area, res. fam. w/6 yr. old, will maint. yard and house, will consider mobile home, duplex or condo. 996-1295.

Want Volvo 15" turbo wheel (5 spokes) in good cond. Vincent, x30874 or 333-1316.

Want carpool starting from SW side and Braeswood, 610 locations to CL/JSC. Rudy, 335-4113.

Want '78 or '79 Honda Accord for parts. David, 486-5259.

Want 4 or 5 BR home, 2,500-3,000 sq. ft. range, non qual. VA or FHA, payment to \$1,200, w/in 15 min. of JSC. 326-3474 or 333-6821.



NASA Illustrations

Changes in Space Station *Freedom's* configuration are reflected in the above diagram, which includes the latest preliminary design review adjustments. The only significant exterior change is the addition of two truss bays that will hold the port and starboard propulsion modules. At left is a cut-away diagram of the habitation module interior layout as currently planned. At top left is an artist's concept of the mobile transporter and mobile servicing center with its robotic arm. Plans for those systems have not changed, but an option to use the mobile transporter base before it is coupled with the arm will not be exercised.

Budget-minded changes alter *Freedom* plans

Several JSC projects are cut, postponed in rephasing

By Billie Deason

Due to a \$300 million cut in the Space Station *Freedom* budget passed by Congress last year, some of the equipment being designed and developed for the station at JSC has been either postponed or cancelled in a move called rephasing.

During summer and early fall 1989, NASA's Space Station *Freedom* program and project managers developed a contingency plan for use should the fiscal year 1990 space station budget be reduced by Congress. When a budget cut from \$2.1 billion to \$1.8 billion did occur in the space station line item of NASA's 1990 budget, many of the proposed scrub options were adopted.

The Space Station team developed a rephased program that maintains the same schedule, simplifies the design and assembly process, supports the station user community and maintains the international agreements with Canada, Japan and the European Space Agency (ESA).

The majority of rephasing changes reduce what engineers call the technical risk of the space station program. By using already available technology, chances diminish for schedules slipping because of development problems. Also, results from ground-based testing and actual hardware use experience increase the reliability of systems and equipment destined for *Freedom*. Since a 30-year life span is planned for the station, reliability and ease of maintenance are key considerations.

The exterior appearance of Space Station *Freedom* is unchanged by the rephasing activity. The truss size and length and the sizes and arrangement of modules, nodes and solar arrays are the same as the baselined configuration. But rephasing eliminates one extravehicular activity (EVA) airlock; the development of a dedicated space station extravehicular mobility unit (EMU), or space suit; reduces some technical systems capabilities; and stretches completion to mid-1999.

At permanent manned capability (PMC), several functions have been reduced. However, by assembly complete (AC), most of the originally planned capabilities will be in place. The changes affect both flight elements and systems. Elements, such as the integrated truss assembly, nodes, airlocks, modules, etc., are the major hardware components of the

station. Systems such as thermal control, communications and tracking, data management and others, outfit the elements and make the station function.

Development responsibility for the space station is divided into work packages among four NASA Centers: JSC, Marshall, Goddard and Langley. Work Package 2, managed by JSC, includes the resource nodes, airlock, mobile transporter and integrated truss assembly among station elements. The systems managed by Work Package 2 include the extravehicular activity (EVA) system; the guidance, navigation and control system; man-systems; the crew health care system; the communications and tracking system; the data management system; the thermal control system; utility distribution; fluid management; and the propulsion system.

The Space Station *Freedom* baseline calls for four fully outfitted resource nodes containing systems equipment and command/control workstations. In the baseline, nodes three and four each have a cupola housing a two-person workstation for proximity operations. The rephased program has two fully outfitted nodes at PMC with the other two containing only minimal utilities and safety equipment. The two baselined cupolas are in place, but have only one workstation each. At AC, all four nodes will be fully outfitted and each cupola will have two workstations.

In place of two airlocks, the rephased design calls for one airlock with hyperbaric treatment capability. The airlock serves as the entrance and exit for EVA crewmembers and equipment. The hyperbaric treatment facility is used to treat decompression sickness. Servicing equipment for the shuttle spacesuits is included in airlock design. Although a space station EMU is not in the current budget, the airlock design will allow for a future station spacesuit and its service equipment. The airlock is attached to Node 1, located between the habitation module and ESA's *Columbus* laboratory module.

Plans for the mobile transporter (MT) and Canada's mobile servicing center (MSC) with its robotic arm are unchanged. But an option to use the MT base independently, before it is coupled with the MSC, has been deleted. Commands to move the MT will be sent through the MSC once

the two systems are combined. Because the mobile transporter carrying the MSC is required for assembling the station, it will be launched on an early assembly flight.

The integrated truss assembly forms the framework for Space Station *Freedom*. The truss supports the modules and nodes and has fixtures to attach systems equipment and externally mounted experiments. The truss also carries trays for the utility cables and lines and rails for the crew and equipment transporter.

As part of the rephasing, two deployable booms that would have held the propulsion system and the communications and tracking antennas were deleted. In their place, two truss bays were added below the standard truss to hold that equipment, one on each end fastened to the last truss bay before the power systems alpha joint. Another change reduces the number of attachment fixtures for external payloads and utilities. At PMC, only two attached payload fixtures and two cargo carriers for spare parts will be available. At AC, four locations are planned for each type of fixture.

Extravehicular activity (EVA) systems at first included a new space station spacesuit, portable and fixed workstations on the truss, handholds, tethers and tools. Among these systems, only the new spacesuit has been eliminated. The station plan now requires the use of shuttle spacesuits. Because of this, there are more stringent limitations on spacewalks, such as planning EVAs only during times when the shuttle is docked at the station. Only very limited spacewalks will be performed from the station for unscheduled work when the orbiter is not present. Additionally, studies are in progress to determine whether robotic devices can take on some of the work previously designated for spacewalking astronauts.

The guidance, navigation and control system (GNC) as baselined controls *Freedom's* orbit and traffic around the station. The autonomous navigation global positioning system has a significantly reduced capability at PMC, with ground uplinks required. At AC, however, the autonomous system will be in place.

Man-systems integration covers all crew interfaces with systems and equipment. To increase the crew's safety and productivity, designs are

analyzed with an eye on the crew members' interactions with hardware, procedures and other items. Experts in areas such as human factors, human engineering and ergonomics evaluate lighting, on-orbit tasks, stowage, housekeeping, trash management, personal hygiene, crew quarters and other subsystems used by the crew.

In the man-systems area, rephasing limits the crew size to four at PMC, with only four crew quarters outfitted, and television cameras and monitors are deleted from the crew quarters. At AC, eight crew members will be accommodated. Restraints and mobility aids are provided on an as-needed basis. The clothes washer and dryer are postponed to AC as are the dishwasher, refrigerator and freezer. One oven is included at PMC, although two ovens will be in place at AC. The personal hygiene system for the habitation module is unchanged at PMC. Both the habitation and U.S. laboratory modules were to have had personal hygiene systems, but this redundancy is reduced to only the toilet compartment and potable and wash water in the lab at PMC. At AC, the lab will add a shower with decontamination capability, and studies are continuing on the need for a complete laboratory hygiene compartment.

The crew health care system includes medical care facilities, an environmental monitoring system and exercise facilities. The crew health care system will be fully operational at PMC with no changes resulting from rephasing.

The communications system as baselined supports space-to-ground data and voice transmissions and space-to-space communications between the station and the shuttle, the station and spacewalking astronauts, and data transmission between the station and free fliers. Communications equipment includes video cameras and audio intercoms.

The predominant rephasing change in communications defers the space-to-space communications capability using the Ku-band. Ku-band is a broader band width allowing more data to be transmitted quicker. UHF will be used for space-to-space communications at first, although the Ku-band for space-to-ground communication remains unchanged. And at AC, Ku-band space-to-space

operations will be implemented.

The tracking system helps with traffic control of the shuttle, logistics modules and co-orbiting platforms while in the vicinity. Because the global positioning system is deferred to AC, tracking of vehicles around the station will be handled by ground-based equipment at PMC, with ground data uplinked to the station as needed.

The propulsion system, mounted on the truss structure, will reboost the station once every 90 days and will control the station's attitude. Rephasing changes the propulsion system from using hydrogen and oxygen propellants manufactured from onboard water to a system that will be fueled by hydrazine. Hydrazine will be carried up to the station on the shuttle.

The data management system (DMS) of the baseline design provides the computer hardware and software to interconnect on-board systems, payloads and operations. The rephased program reduces the station's data handling capacity. Three high data rate links at PMC replace the originally planned eight high-rate links. At AC, however, all eight high rate links will be installed. Instead of developing new computer display screens, at PMC existing display technology will be used. At AC, the displays will be upgraded.

The thermal control system, including both passive and active devices, maintains the required temperatures for the crew, the station's equipment, the elements and some users' equipment. The heat collected by the active two-phase ammonia coolant loops is collected and transported to two sets of radiators for rejection. Located port and starboard on the truss structure just inboard of the power systems alpha joint, these radiators can be rotated away from the sun, allowing the maximum heat to be rejected into space.

The utility distribution system at first provided deployment, routing and protection for fluid, electrical and data utilities. Redundant utility trays were part of the baseline design, however their installation has been postponed until AC as part of the rephasing. In addition, method integrated nitrogen, water and waste gas systems, has only one change in rephasing. The maximum gaseous nitrogen supply pressure has been reduced from 6,000 to 600 pounds per square inch.

JSC employees receive awards for inventions, patents

JSC Director Aaron Cohen presented NASA Tech Brief, Patent Application and Inventions and Contributions Awards to 26 JSC employees in an April 18 Space Act Awards ceremony in Bldg. 1.

Recipients of the NASA Tech Brief Awards were:

Joseph J. Kosmo, for a "Rolling Convolute Metacarpal Finger Joint for Pressurized Glove Mobility;" Timothy

E. Fisher, for an "Improved Architecture for Performing Coordinate Transforms;" Phuong-Dung T. Hoang, for a "Discrete Data Acquisition PS/2 Board;"

Clarence J. Wesselski and Erik E. Evenson for a "Collet/Flex Drive Robotic Joint;" Steven L. Koontz, for "A New Process for Anisotropic Photoresist Etching and Multi-Layer Lithography;" and Richard T. Walter for a

"Volumetric Measurement for Container Contents Gauging."

Recipients of Patent Application Awards were:

Robert C. Ried, Brian P. Ross, George A. Zupp Jr., Wayne L. Peterson and Christopher J. Cerimele, for an "Assured Crew Return Vehicle;" Lubert J. Leger and Steven L. Koontz, for "Modification of the Surfaces of Bio-Medical and Bio-Technical Devices

Using Atomic Oxygen;" Peter M. Fantasia for an "Alignment/Positioning Mechanism;" and William E. Thornton, for an "Means for Isolation of Shock and Vibration in Spacecraft."

Inventions and Contributions Awards went to:

William R. Acres, for a "Preloadable Vector Sensitive Latch;" Hatice S. Cullingford, for an "Apparatus for Storing Hydrogen Isotopes;" Winston

D. Goodrich, Edgar O. Castro, Clarence J. Wesselski, Timothy E. Pelischek, Bruce H. Becker, John B. Kahn, Margaret E. Grimaldi and John P. McManamen, for the "Orbiter Escape Pole;" Guy L. King, for a "Double Swivel Toggle Release;" and Benjamin Mosier, for a "Method of Making a Perspiration Resistant Bio-potential Electrode and Pressed Disc Type Sending Electrodes with Ion Screening Means."

Welcome home ceremony set for Sunday

If the STS-31 mission continues to be on schedule, JSC employees and their families will be able to welcome home the crew about 3 p.m. Sunday at Ellington Field.

The ceremony will be approximately 7 hours after the shuttle lands at Edwards Air Force Base, Calif., now scheduled for 8:49 a.m. CDT Sunday.

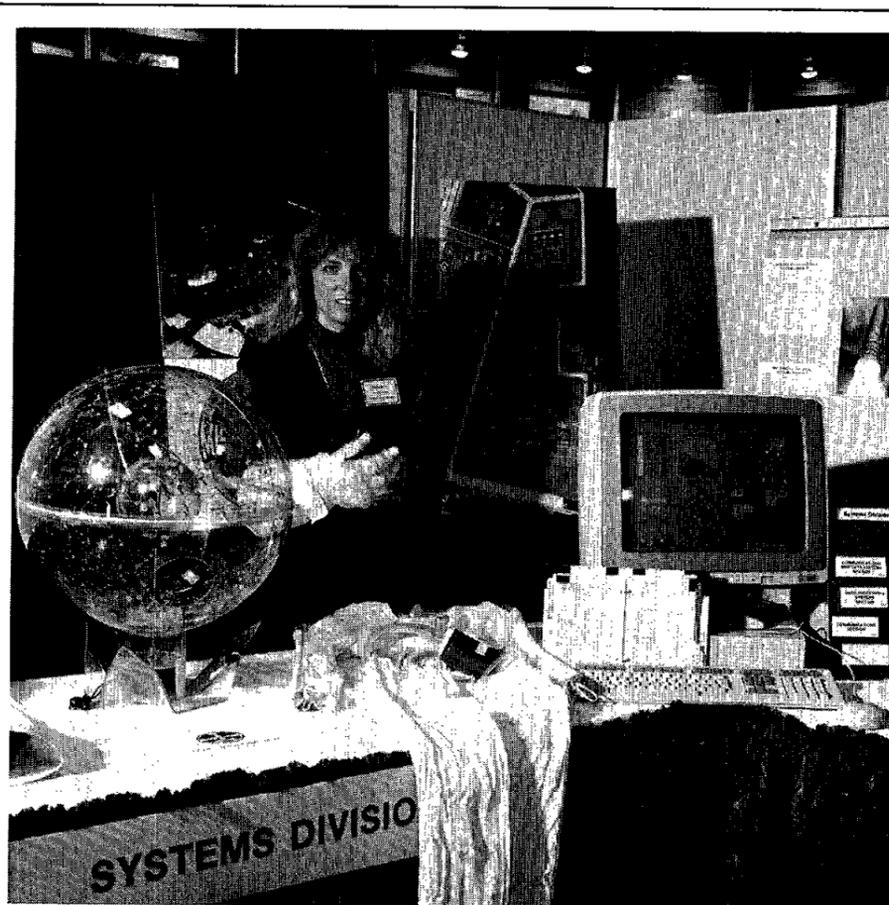
The crew return ceremony time and location may change if the landing time changes. For the latest information on the return ceremony, call the Employee Information Service at x36765.

MPAD employees plan wake and reunion

After almost 27 years, the Mission Planning and Analysis Division (MPAD) is being disbanded and its current and former civil service employees are holding a wake and reunion.

The event will be from 4-8 p.m. June 15 at the Gilruth Recreation Center Pavilion. Reservations should be made as soon as possible by contacting Faye Conway, Mail Code ET, Jeanette Fanelli, EG, Shirley Huss, TZ, or Gloria Martinez, ET. Deadline for reservations is June 4.

MPAD logo T-shirts and logo patches may be ordered from Martinez, but orders are due May 10. All orders must be paid for in advance. Place orders with Martinez at x38091 or Bldg. 30, Rm. 3004.



JOB FAIR—Cooperative Education student Sheryl Kriss displays some tools of the trade for the Mission Operations Directorate's Systems Division during the recent Coop Job Fair. She was one of 48 coops who gathered in the Gilruth Recreation Center on April 20 to compare notes on JSC job experiences and opportunities. The job fair was coordinated by coops Trang Le, David Phillips, Kim Grayson, Karen Watson and Kathleen Sparks.

JSC Photo by Benny Benavides

Goddard's Townsend retires

New directors appointed for Goddard, Lewis

NASA Administrator Richard H. Truly this month appointed new directors for both Goddard Space Flight Center (GSFC) and Lewis Research Center (LeRC).

Dr. John Klineberg becomes director at Goddard in Greenbelt, Md., and Lawrence J. Ross becomes director at Lewis in Cleveland.

The appointments, which came about after Dr. John W. Townsend retired as Goddard's director, are effective July 1.

Klineberg, a 20-year NASA veteran, has been LeRC director for the past three years.

He joined NASA at Ames Research Center, Moffett Field, Calif., conducting research in the area of transonic flow and methods for calculating air boundary layer separation. In 1974, he moved to NASA Headquarters, Washington, D.C., as head of the low speed aircraft branch in the Office of Aeronautics and Space Technology, eventually rising to deputy associate administrator for aeronautics and space technology. He was assigned to LeRC as deputy director in 1979 and was named director in 1987.

Ross joined NASA in 1963 and has been deputy director of the center since December 1987. As deputy director, Ross has shared responsibility for organizing, controlling and accomplishing missions assigned to the center.

During most of his career, Ross has served in an executive capacity. He also has been a design and test engineer responsible for environmental testing of the Centaur launch vehicle stage and for integration of the Surveyor spacecraft with the Atlas/Centaur launch vehicle.

Discovery puts Hubble Space Telescope on station

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uneventful. The port solar array had unfurled without incident, but a microswitch that was supposed to verify complete deployment failed to register. Controllers at the STOCC later verified that deployment was complete.

While they awaited confirmation on the port solar array, STOCC controllers decided to proceed with deployment of the telescope's two high-gain antennas to preserve HST release opportunities later in the day.

After the telescope was released over the Pacific Ocean, Hawley powered down and stowed the robot arm, and McCandless and Sullivan climbed out of the airlock and their extravehicular mobility units (EMU). Two separation burns were conducted to move the shuttle away from the telescope.

Before the crew went to bed, Sullivan activated the middeck payload Investigations into Polymer Membrane Processing (IPMP). The objective of the IPMP is to flash

evaporate mixed solvent systems in the absence of convection to control the porosity of a polymer membrane.

Sullivan and McCandless also observed the progress of the Protein Crystal Growth (PCG) experiment.

After awaking on Flight Day 3 to congratulations from HST team members across the country, the crew worked with the student experiment designed by Gregory Peterson, now a chemistry major at Utah State University. The Investigations of Arc

and Ion Behavior in Microgravity is designed to test whether an electric arc in a sealed aluminum chamber will arch or move in any direction, as happens on Earth, when free of gravity-driven buoyancy forces.

The crew also spent time taking Earth observations photography, and took a look at impending storms forming over the Houston area.

Shriver also reported finding a watch misplaced by Astronaut Sonny Carter during STS-36, but did not say where or how it was discovered.

The successful HST deployment was made possible by a nearly flawless launch at 7:33:51 a.m. CDT. The launch was delayed by almost three minutes while ground controllers performed troubleshooting measures on the liquid oxygen outboard fill-and-drain valve on the vehicle. Once the valve was verified closed, the count was resumed at T minus 31 seconds.

Landing at Edwards Air Force Base, Calif., is scheduled for 8:49 a.m. CDT Sunday.

Space News Roundup

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Procurement organization adjusts to meet demands

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Desmond C. Danks has been named to head the Huntington Beach Resident Office, and Thomas

Krenek, former Engineering Procurement Branch chief, has been named chief of the new Aircraft Operations and Materiel Procurement Branch.

Other personnel changes included the assignment of Randy Gish as chief of the Orbiter and Shuttle Integration Procurement Branch (BC411) and Sharon Delp

as chief of the Engineering Procurement Branch (BE211), and the selection of Bill Bays as deputy chief of the Space and Center Operations Procurement Division (BG).

Crawler passes 1,000-mile mark delivering Columbia

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During its travels, Transporter 2 has been operated by 10 different drivers and has supported Apollo, Skylab and space shuttle missions. Its heaviest load was the Saturn V/Skylab workshop on its mobile launch platform. The combined weight of the platform, launch vehicle and payload totaled 13.2 million pounds—more than twice the weight of the transporter.

Following a year of study, NASA decided in 1962 that the land transport method of space vehicle delivery to the pad was the most feasible and awarded a contract in 1963 to the Marion Power Shovel Co., Marion, Ohio, to build two of the massive vehicles.

When built, the transporters dwarfed the self-propelled, strip-mining shovels from which they were patterned. In addition to weighing

3,000 tons apiece, the load-carrying tops are 131 feet long and 114 wide (the size of a baseball diamond). The height of the top is adjustable by hydraulic jacks, from 20 feet to 26 feet.

Two 2,750 horsepower diesel engines provide main propulsion power to drive the four 1,000 kilowatt generators. Additionally, two 1,065 horsepower diesel engines drive two 750 kilowatt generators which power the leveling, jacking, steering, lighting and other on board equipment systems.

Sixteen traction motors, four on each truck, are rated at either 187 or 375 horsepower each. Each of four double-tracked trucks is 10 feet high and 40 feet long. A single shoe on the track belt weighs a ton. There are 57 shoes per belt, and eight belts per transporter.

With a turning radius (500 feet) that

makes jeep owners cringe, the transporters move at a top speed of 2 mph unloaded. Moving a space shuttle to the pad, the crawlers average less than 1 mph.

In 1969, the transporters won the Great Britain Royal Automobile Club's third Diamond Jubilee Trophy Award and Buchanan was there to accept.

Once the crawler reaches the pad with its launch vehicle riding piggy-back, the leveling system kicks in during the climb up the 5-percent grade allowing the tip of the shuttle's external tank to vary no more from the vertical than the diameter of a basketball.

As the largest land vehicles ever built, the crawlers in 1977 were designated as National Historic Mechanical Engineering Landmarks by the American Society of Mechanical Engineers.

Later that year extensive modifications were made including the installation of a new central control room and the addition of a programmable controller capable of rapid troubleshooting if a problem occurs during a critical move. Also, a laser docking system was installed allowing the driver to dock the vehicle within one inch of the target.

Transporter 2 was also outfitted with an odometer. A plaque certifying the previously logged miles was placed in the cab. With the 644 miles logged prior to the modifications added to those during the shuttle program, the transporter surpassed the 1,000 mile mark carrying Columbia to pad 39A for its next launch scheduled for around May 16.

The crawlers, which cost just under \$15 million for both, are expected to continue in service well into the next century.